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Factors influencing public transport mode choice in Maseru and northern Lesotho

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Abstract

The study aimed at determining factors that influence commuters' choice of public transport mode in the study area. Catch-a-ride was the popular public transport mode as it was used by 60% of the commuters while mass buses and taxis were used by 30% and 10% of the commuters, respectively. Age of the commuter, perceived safety of the vehicle, no-switching between vehicles, perceived comfort of the vehicle, attitude of the driver and/or conductor and observed condition of the vehicle have a significant influence on the use of catch-a-ride among commuters in the study area. Household income and the perceived social status have a significant influence on the use of taxis among commuters while the perceived safety of the vehicle, attitude of the driver and conductor and the cost of the trip had a significant influence on the use of mass buses. It is concluded that commuter, driver, and vehicle specific factors have an influence on the commuters' choice of public transport mode for their journeys. To improve the situation, drivers and conductors should be trained on customer care and, catch-a-ride mode of transport should be regulated to avoid conflicts with other regulated modes of public transport.

Keywords: Determinants; Public Transport; Mode; Choice; Commuters

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1. Introduction

Transport is one of the most important aspects of the day-to-day life of the people, as their activities cannot be fulfilled without moving. The people's movement is closely related to their social demographic characteristic such as gender, age, marital status, occupation, education level as well as the activities of the family members. The activities are based on different purposes, which are working activities, educational activities, and shopping, recreational activities and so on (Maduwanthi et al., 2016). Public transport is an infrastructure that is provided to facilitate users in mobility and buses, trains, taxis, ferries, and airlines are examples of public transport. There are two main purposes of provision of public transport, which are served by patronage and served by coverage (Horcher and Tirachini, 2021). Public transport is provided by both public and private sector with the purpose of private sector being to create income while that of public sector is to provide services that are essential for the economy to be effective and efficiently functional (Kamarudin and Sinniah, 2021).

The people consider the choice of travel modes according to the purpose of the trip that is to be fulfilled. There is availability of different travel modes, and people can choose the mode of their desire to complete their trip. The traveling modes are now coming with different aspects from the conventional models. Now people tend to choose the mode based on the comfort, safety, time reliability, cost of the travel mode, etc. With availability of different travel modes, the people have various opportunities to choose the mode (Maduwanthi et al., 2016). In addition, factors such as condition of the vehicle and attitude of service providers (Drivers and conductors) were found to be some of the factors that influence choice of public transport mode in both developed and developing countries. Furthermore, demographic characteristics of commuters such as age, gender and income levels were also identified as determinants of commuters' choice of public mode of transport around the world (Mayo and Taboada, 2020).

In Lesotho, public transport has been available since the colonial era and has been the means of transportation for masses to date. The public transport system of the country has always been characterized by both public and private service providers spread across the ten districts of the country whereby the state provided buses for both long and short distance trips throughout the country (Senamolele, 2020). The local private sector provides different modes of transport such as buses, coasters, and taxis for both long and short distance journeys. Nonetheless, lately the country witnesses the emergence and entry of imported hatch backs known as "catch-a-ride" for long distance trips. These are private cars operating commercially across the ten districts of the country. These new category of service providers are not regulated by the relevant authorities such the Ministry of Transport and Ministry of Police and has led to some conflicts between them and traditional service providers (Buses, coasters, and taxis). According to Senamolele (2020), the demand and use of these new public transport modes has increased sharply over the last three years to the detriment of other modes of public transport modes in the country. This situation has led to the study seeking to investigate factors that influence commuters' choice of public transport mode in the country.

Several international studies have been conducted to investigate the factors that influence commuters' choice of public transport modes in both developing and developed countries of the world. The study by Mohale (2021) focused on the challenges facing public transport system in the country, while that of Monyane (2021) focused on the impact of public transport on the well-being of local commuters. These two studies did not discuss factors influencing commuters' choice of public transport modes in Lesotho.

The topic is of importance for policy makers in Lesotho where reliance on public transport is high among Basotho commuters compared to the more developed countries. The contribution of this study is two-fold. First, it includes various variables as predictors of commuters' choice and use of local public transport system offerings, which are essential to identify key factors and entities that influence use of this critical service in the country. Second, this study uses data of the most populated cities and the cities with highest population of commuters and public transport service providers in Lesotho. Therefore, the findings of this study are appropriate to be used as references in policy making in Lesotho.

1.1. Objective of the research

- To determine factors that influence commuters' choice of public transport mode in the capital city and northern districts of the country.

2. Methodology

2.1. Description of the study area

The study was conducted in the capital city, Maseru, and the three northern districts of Lesotho which are Berea, Leribe and Butha-Buthe. These four districts were chosen because they have the highest population of commuters and public transport service providers compared to other regions of the country (Bureau of Statistics (BOS), 2022). According to the BOS (2023), Maseru has a population of 470 000 and is located at latitudes 28o E and 29o W and the longitudes 27o N and 30o S. Leribe district has a population of 274 170 and is located between latitudes 28o E and 31o W and the longitudes 27o N and 30o S. Berea district has a population of 262 616 which accounts for 13.3% of the total population of the country and this district is located at latitude -29.1o and longitude 27.9o while Butha-Buthe is located at latitude -28.7o and longitude 28.2o with a total population of 118 242.

2.2. Sampling procedure

The target population for this study was commuters that used different public transport modes to travel in the four selected areas of Lesotho. Multi-stage sampling procedure was used in the study. In the first stage, purposive sampling was used to select the four districts of Maseru, Berea, Leribe and Butha-Buthe. In the second stage, mass bus, coasters, and taxi terminals and "catch-a-ride'' spots were selected as places of interactions with commuters across the four selected districts. In the third stage, simple random sampling was used to select commuters to be involved in the research to come up with a total of 600 commuters for the study. This random selection was achieved by selecting every fourth passenger seated in the waiting areas designated for passengers across the bus/taxi ranks. Concerning the "catch-a-ride", this was achieved by selecting every third passenger waiting at a "catch-a-ride" pick up point across the country. Data were collected from these commuters through a structured questionnaire which was pre-tested before the execution of the main survey to ensure content validity and internal consistency, using Cronbach's Alpha formula which generated a coefficient of 0.7 hence, acceptable. The research instrument items of focus included those of safety, comfort, attitude, and condition.

2.3. Data analysis

To analyse relevant data, descriptive statistics were used together with the multinomial logistic regression model. Specifically, descriptive techniques were used to describe public transport modes available for commuters in the study area whereby the main descriptive indicators that were employed were frequency, percentage, and mean values. To determine factors that influence commuters' choice of public transport Mode, Multinomial logistic regression model was used. This model can be used to predict a dependent variable based on continuous and/or categorical independent variables where the dependent variable takes more than two forms, in this case, mass buses, coasters, taxis and "catch-a-ride'' (Rantlo et al., 2021). Logistic regression does not assume a linear relationship between the dependent variable and independent variables but requires that the independent variables be linearly related to the logit of the dependent variable (Gujarati, 1992). However, Pundo and Fraser (2006) explain that the model allows for the interpretation of the logit weights for the variables in the same way as in linear regression.

The commuters under study are faced with four choices mass buses, coasters, taxis and "catch-a-ride''. It is assumed that these decisions are made based on the option which maximises their utility, subject to various constraints. As such, the utility maximising function can be given as:

$$\text{Max } U = U (Ck, Rfk, Rik; Hu) \quad (1)$$

where;

Max U denotes the maximum utility that can be attained from mode of transport.

Ck represents the consumption of services by the commuter.

Rfk represents gains accruing from a public transport mode of choice.

Rik represents gains accruing from alternative public transport modes.

Hu represents a set of factors shifting the utility function.

From the utility maximising function, commuters make decisions to use a public transport mode, subject to various factors. Therefore, if the costs associated with using a particular public transport mode are greater than the benefits, commuters will be discouraged from using it, shifting to the option that maximises their utility. However, it is difficult to measure utility directly; therefore, it is assumed that commuters make participation choices depending on the options that maximise their utility. Thus, decisions to use either mode of public transport or even not using signify the direction which maximises utility. With the given assumption, multinomial regression was used to relate the decisions to choose either of the four available public transport modes or not and the factors that influence these choices (Jari and Fraser, 2009).

A typical logistic regression model which was used is of the form:

$$\text{Logit } (P\,i) = \ln (P\,i / 1 - P\,i) = \beta 0 + \beta 1\, X\, 1 + \beta 2\, X\, 2 + \beta 3\, X\, 3 + \ldots + \beta i\, X\, i + e$$

where:

ln (P i / 1 – P i) = logit for public transport mode choice

Pi = not choosing public transport

1- Pi = choosing a public transport mode

Xi = independent variables

βi = parameters to be estimated

e = error term

The multinomial regression model specification for public transport mode choice is presented as follows:

$$(P\text{choice_of_public transport mode}) = \beta 0 + \beta 1\ AG + \beta 2\ HHI + \beta 3\ SOCS + \beta 4\ SOV + \beta 5\ SBV + \beta 6\ COMVI + \beta 7\ ATT + \beta 8\ COST + \varepsilon i$$

The description of the explanatory variables and their expected relationships to the dependent variable are presented in Table 1.

Table 1. Description of the explanatory variables used in the model

Variable name	Definition	Expected sign
Age (AG)	Number of years	+/-
Household Income (HHI)	Monthly Amount (Maloti)	+/-
Self-perceived social status (SOCS)	1 if high, 0 if otherwise	+
Safety of the vehicle (SOV)	1 if high, 0 if otherwise	+
No-switching between vehicles (SBV)	1 if yes, 0 if otherwise	+
Comfort of the vehicle (COMVI)	1 if yes, 0 if otherwise as perceived by commuters	+
Attitude of driver/conductor (ATT)	1 if good, 0 if otherwise: as perceived by commuters	+
Cost of the trip (COSTS)	1 if affordable, 0 if otherwise	+
Condition of the vehicle	1 if good, 0 if bad: as perceived by commuters	+
Time cost of the trip	1 if long, 0 if enough	-

3. Results and Discussion

3.1. Descriptive results

Results revealed that 60% of commuters used the catch-a-ride mode of public transport and 30% preferred to use mass buses while the remaining 10% used taxis for their journeys across the study area. Forty percent (40%) of the commuters were aged between 18 and 35 years while 42% were aged between 36 and 55 years.

Sixty-five percent of the youth (18-35 years old) used catch-a-ride, 20% of them utilised mass buses, while the remaining 15% used taxis. Those aged above 55 years of age accounted for 18% of the commuters and majority of them (60%) used mass buses, while 40% of them used catch-a-ride. For those aged between 36 and 55 years, 60% of them used catch-a-ride, mass buses were used by 35% of them, while 5% used taxis to travel. In terms of household income, only 10% received M 8000.00 per month and 15% received between M 4000.00 and M 7999.00 per month while 40% received between M 2000.00 and M 3999.00 per month. The household income below M 2000.00 was received by the remaining 35% of the commuters in the study area. Twenty percent of the commuters perceived their social status to be high and 30% considered themselves to be of average social status while the remaining 50% considered themselves to be of low social status.

Vehicle specific features such as the condition of the vehicle were cited as factors considered by 55% of the catch-a-ride users for their journeys. They indicated that this mode of transport is characterised by good conditioned vehicles that do not damage their clothes as seats are not dilapidated compared to other modes of public transport. Moreover, 65% of the commuters considered catch-a-ride a comfortable mode of public transport as they are never overloaded like other alternative modes of public transport. Furthermore, 40% of the respondents considered catch-a-ride a safe mode of transport while 30% considered mass buses a safe mode of transport. These two modes of transport were considered safe because they are driven with great caution and their drivers observe road and traffic rules and regulations compared to other modes of public transport.

Good attitude of the driver and/or conductor is one of the factors that are highly considered by commuters that use catch-a-ride mode of public transport. Furthermore, 38% of mass bus users considered this factor when choosing their mode of public transport. These two categories indicated that drivers and/or conductors for catch-a-ride and mass buses are cooperative, respectful and offer good passenger care compared to other alternative modes of public transport, taxis in particular where passengers are shouted at, harassed and disrespected.

Seventy percent (70%) of the commuters preferred catch-a-ride because it is direct and not characterized by switching between vehicles during the journey and they indicated that a passenger uses one vehicle to get to their destination unlike in other alternative modes. They indicated that this non-switching between vehicles during the journey reduces the chances of damage to and loss of their luggage. The remaining 30% of the commuters did not consider this factor when choosing their mode of public transport for their journeys across the study area. The taxi fares are the highest as they are about 30% and 5 to 10% higher than those of mass buses and catch-a-ride, respectively. Fifty-five (55%) percent of the commuters considered this cost of the trip when choosing their public transport mode for their journeys while this factor did not matter that much for the remaining 45% of the commuters in the study area.

3.2. Factors influencing public transport mode choice among commuters in the area

The results of the multinomial logistic regression model are presented in Table 2 and discussed in this section of the paper, whereby the coefficients (β), standard error (S.E), significance values (p-values) and odd ratios are displayed for each explanatory variable. The Pseudo R^2 value of 31.6% demonstrates that more than almost a third of the variability in choice of transport mode can be explained by the included variables. The taxi mode of transport was used as the base outcome group in this study.

Age: this variable was found to have a positive and significant relationship with the commuters' use of *catch-a-ride* as it had a regression coefficient of 2.435 and a p-value of 0.004. This result from Table 2 implies that there is enough evidence to suggest that a unit decrease in age results in a 2.4 unit increase in the use of the *catch-a-ride* as a mode of transport. The possible explanation for this situation is that young people are receptive to change and prefer new concepts across almost all facets of their lives. The results agree with Mussone and Changizi (2023) that young people use new modes of public transport in most areas in both developed and developing countries.

Household income: the results in Table 2 revealed that this variable has a positive and significant influence on commuters' use of taxis as a public transport mode as it had a regression coefficient of 2.432 and a p-value of 0.018. This finding means that there is enough evidence to support that a unit increase in household income leads to a 2.4 unit increase in commuters use of taxis as a public transport mode. The possible explanation for this situation is that people with high income levels could afford the relatively high taxi fares and, these results are in line with Vasudevan et al. (2021) that high income level commuters use high-cost mode of public transport in most countries.

Self-Perceived Social status: this factor was found to be positively and significantly influencing commuters' use of taxis as a public transport mode since it recorded a regression coefficient of 4.145 and a p-value of 0.022. The findings imply that there is enough evidence to suggest that a unit increase in self-perceived social status results in a 4.1 unit increase in commuters' use of taxis as a public transport mode. The probable explanation for the scenario is that people who perceive themselves to be of high status prefer expensive things in life. These findings agree with Sompie (2022) that commuters of high status prefer taxis as a mode of transport in most developing countries.

Safety of the vehicle: the variable positively and significantly influences the use of catch-a-ride as a public transport mode as it recorded a regression coefficient of 1.766 and a p-value of 0.014. Furthermore, this variable was found to have a positive and significant relationship with commuters' use of mass buses as a public transport mode as it had a correlation coefficient of 2.870 and a p-value of 0.011. The results indicate that there is enough evidence to suggest that a unit increase in the safety of the vehicle led to a 1.7 unit increase in commuters' use of catch-a-ride and a 2.8 unit increase in commuters' use of mass buses. The explanation for this situation is that commuters indicated that the catch-a-ride and mass busses are not driven recklessly, and they observe transport rules and regulations hence, safety of these two modes of public transport. These findings agree with Goransson and Andersson (2023) that commuters mostly prefer safe modes of public transport that are driven with caution and observe road and transport rules and regulations for their journeys.

No-switching between vehicles: this independent variable was found to be positively and significantly influencing commuters' use of catch-a-ride for their journeys as it recorded a regression coefficient of 4.801 and a p-value of 0.033. The results imply that there is strong evidence to suggest that a unit increase in no-switching between vehicles led to a 4.8 increase in commuters' use of catch-a-ride as a public transport mode. The explanation for this scenario is that catch-a-ride is direct to the commuters' destination and this also reduces the chances of loss and damage to their luggage compared to other modes where switching between vehicles is common hence, preference by commuters. The study is in line with Garcia and Saez (2016) that

commuters prefer public transport modes that take them direct to their destination relative to those in which switching between vehicles is common.

Comfort of the vehicle: the variable positively and significantly influenced the relationship with commuters' use of catch-a-ride for their journeys as it had a regression coefficient of 3.312 and a p-value of 0.044. The findings mean that there is enough evidence to support that a unit increase in the comfort of the vehicle led to a 3.3 unit increase in commuters' use of catch-a-ride in the study area. The explanation for this situation is that commuters indicated that catch-a-ride vehicles are comfortable as they are never overloaded hence, comfortable. The findings are in line with Jiang et al. (2012); Bauer and Kisielewski (2021) that commuters prefer and make more use of public transport vehicles that are more comfortable for their trips in most contexts.

Attitude of driver/conductor: the results revealed that this variable has a positive and significant influence on the commuters' use of different modes of transport in the study area. First, the results showed that the variable positively influenced the use of catch-a-ride for the commuter's journeys as it had a regression coefficient of 4.980 and a p-value of 0.049. Moreover, this variable positively and significantly influenced the commuters' use of mass buses for their trips as the relationship recorded a regression coefficient of 1.9 and a p-value of 0.028. The results imply that a unit increase in the good attitude of the driver and/or conductor led to a 4.9 unit increase in commuters' use of catch-a-ride and a 1.9 unit increase in commuters' use of mass buses for their journeys. The explanation for this scenario is that commuters indicated that drivers and/or conductors for mass buses and catch-a-ride offer them good customer care as they do not shout and/or swear at passengers compared to other modes of public transport hence, their preference of these two modes of public transport. The findings are supported by Arroyo et al. (2020) when stating that commuters are more attracted to public transport vehicles whose drivers and/or conductors offer good customer care (do not shout, swear and disrespect passengers) across both developing and developed countries.

Condition of the vehicle: this independent variable was found to be positively and significantly influencing commuters' use of catch-a-ride for their journeys in the study area as it recorded a regression coefficient of 1.900 and a p-value of 0.030. This result implies that there is enough evidence to suggest that a unit increase in the goodness of the vehicle's condition led to a 1.9 unit increase in the use of catch-a-ride among commuters in the study area. The explanation for this situation is that commuters indicated that most catch-a-ride vehicles are in good overall condition and their interior (E.g., seats, etc.) are not dilapidated and do not damage their clothes as a result hence, commuters' preference of these vehicles. The findings of this study agree with those of Witchyaphong et al. (2020) that the condition of the vehicle is one of the main factors that influence commuters' choice of public transport mode.

Cost of the trip: the results revealed that this independent variable had a positive and significant relationship with commuters' choice of mass buses for their journeys in the study area as it had a regression coefficient of 3.229 ana a p-value of 0.040. These findings mean that there is enough evidence to suggest that a unit increase in the cost of the trip led to a 3.2 unit increase in the use of mass buses among commuters. The explanation for this situation is that mass buses are the cheapest mode of public transport mode hence, affordable for most of the poor Basotho that struggle to make ends meet. These findings are supported by Vasudevan et al. (2021) that most commuters prefer mass buses because they are the cheapest of all modes of public transport in developing countries.

Table 2. Multinomial logistic results for public transport mode choices among commuters

	MASS BUSES			TAXIS			CATCH-A-RIDE		
Variable	**Coefficient**	**Standard Error**	**Significance**	**Coefficient**	**Standard Error**	**Significance**	**Coefficient**	**Standard Error**	**Significance**
Age (AG)	-2.987	1.236	1.980	2.950	1.912	0.704	-2.435	0.115	**0.004***
Household Income (HHI)	-3.098	2.258	0.961	2.432	0.205	**0.018***	1.287	0.301	0.876
Social Status (SOCS)	2.343	1.762	1.732	4.145	0.324	**0.022***	2.908	1.432	0.540
Safety of the Vehicle (SOV)	2.870	0.204	**0.011***	11.562	1.766	0.768	1.801	0.288	**0.014***
No-switching between Vehicles (SBV)	3.981	1.121	0.908	0.769	2.554	1.763	4.801	0.343	**0.033***
Comfort of the Vehicle (COMVI)	1.230	2.062	1.976	15.925	0.405	0.910	3.312	0.476	**0.044***
Attitude of Driver/Conductor (ATT)	1.973	0.193	**0.028***	1.095	0.308	0.703	4.980	1.823	**0.049***
Cost of the Trip (COSTS)	3.229	0.221	**0.040***	2.457	1.433	0.620	0.209	2.487	0.699
Condition of the Vehicle	-5.522	0.302	0.598	13.543	0.720	0.796	1.900	0.155	**0.030***
Time cost of the Trip	2.667	1.072	1.098	2.950	2.773	0.605	1.456	0.321	0.713

*Number of observations = 600 LR chi (40) = 54.42 Prob > Chi2 = 0.742 Pseudo R2 = 0.3162 Log likelihood = -71.00452 *Statistical significance at 5% level*

4. Conclusion and recommendations

Catch-a-ride is the public transport mode of choice for most Basotho commuters in the country as it is preferred and used by 60% of commuters while 30% and 10% prefer and use mass busses and taxis, respectively. Low bus fares and good attitude of the drivers and conductors render the environment conducive for use of mass buses among commuters in the study area. The use of mass buses in augmented by the safety of mass buses as they are driven with caution and observe road and traffic rules and regulations.

Social status and high-income level render the environment conducive for use of taxis by some segments of Basotho commuters in the area while the use of this mode of public transport was negatively affected by factors such as bad attitude of drivers and conductors, reckless driving, overloading, poor condition of the vehicles and switching between vehicles.

Vehicle specific features such as good condition, comfort and safety of the vehicle are some of the factors that rendered the environment conducive for use of *catch-a-ride* among commuters in the study area. The use of *catch-a-ride* was further enhanced by no-switching between vehicles during the journey and good attitude of the drivers in the study area.

To address the challenge of poor customer service, taxi operators should train their drivers and conductors on customer care, and they should also instill overall discipline among their employees. In addition, they

should well maintain their vehicles even the interior that most commuters complain about. Furthermore, the taxi and mass bus operators must develop strategies to reduce the undesirable switching between vehicles that currently characterizes these modes of public transport.

Currently, *catch-a-ride* is the most popular and preferred mode of public transport and highly used by the youth, which probably means a great and bright future for this concept in the study area, albeit unregulated by the Ministry of Transport. Considering this, it is recommended that *catch-a-ride* be regulated by the Ministry of Transport in the country to avoid conflicts between it and other regulated modes of public transport in the country.

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